Fivemile, Ninemile, Tenmile, and Fifteenmile Creeks

Results and Field Summary

State of Idaho
Department of Environmental Quality

February 2012

Cover photograph is Fivemile Creek at Franklin Road (Hawk Stone, September 2011)

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Introduction

The Idaho Department of Environmental Quality (DEQ) is currently working on a subbasin assessment, which may lead to total maximum daily loads (TMDLs), for the following assessment units:

- ID17050114SW007_04—Fifteenmile Creek
- ID17050114SW008_03—Tenmile Creek (downstream of Blacks Creek Reservoir)
- ID17050114SW010_02—Ninemile Creek
- ID17050114SW010_03—Fivemile Creek (downstream of New York Canal)

Each of these assessment units has preliminary data that indicate a potential *E. coli* impairment, but the Idaho water quality standards require a very specific sampling regime to confirm this:

> Waters designated for primary or secondary contact recreation are not to contain E. coli bacteria in concentrations exceeding a geometric mean of one hundred twenty-six (126) E. coli organisms per one hundred (100) ml based on a minimum of five (5) samples taken every three (3) to seven (7) days over a thirty (30) day period. (IDAPA 58.01.02.251.01a)

The previous bacteria data were not sufficient to address this criterion.

In addition, each of these assessment units, with the exception of ID17050114SW010_02 (Ninemile Creek), is found on the 2010 §303(d) list for impairment by sediment. Although sediment data sets have been collected throughout the watershed, they were often sparse or more than 5 years old, thereby not meeting DEQ's "Tier I" threshold for data quality. The exception was Fifteenmile Creek, which had a robust data set collected in 2008. Data were insufficient to determine whether Fivemile and Tenmile Creeks met the Lower Boise River TMDL target of 50 milligrams per liter (mg/L), averaged over a 60-day period.

At its June 6, 2011, meeting, the Indian Creek technical advisory committee instructed DEQ to prepare a monitoring plan for any data gaps that must be filled before the TMDLs could be written. The completed monitoring plan was published on the Lower Boise TMDL website in mid-June. The goals of the plan were as follows:

1. Collect geometric mean bacteria data from Fivemile, Ninemile, Tenmile, and Fifteenmile Creeks in irrigation and non-irrigation seasons (in July and November, respectively).
2. Collect biweekly sediment data from Fivemile and Tenmile Creeks in irrigation and non-irrigation seasons (between June and November).

Turbidity was later added as an analyte as well.

Sites

The technical advisory committee recommended the following monitoring locations (Figure 1):

- Fivemile Creek at the mouth (i.e., Franklin Road crossing)
- Ninemile Creek at the mouth (i.e., Ustick Road crossing)
- Tenmile Creek at the mouth (i.e., Franklin Road crossing)
- Fifteenmile Creek at the mouth (i.e., upstream from the Boise River)

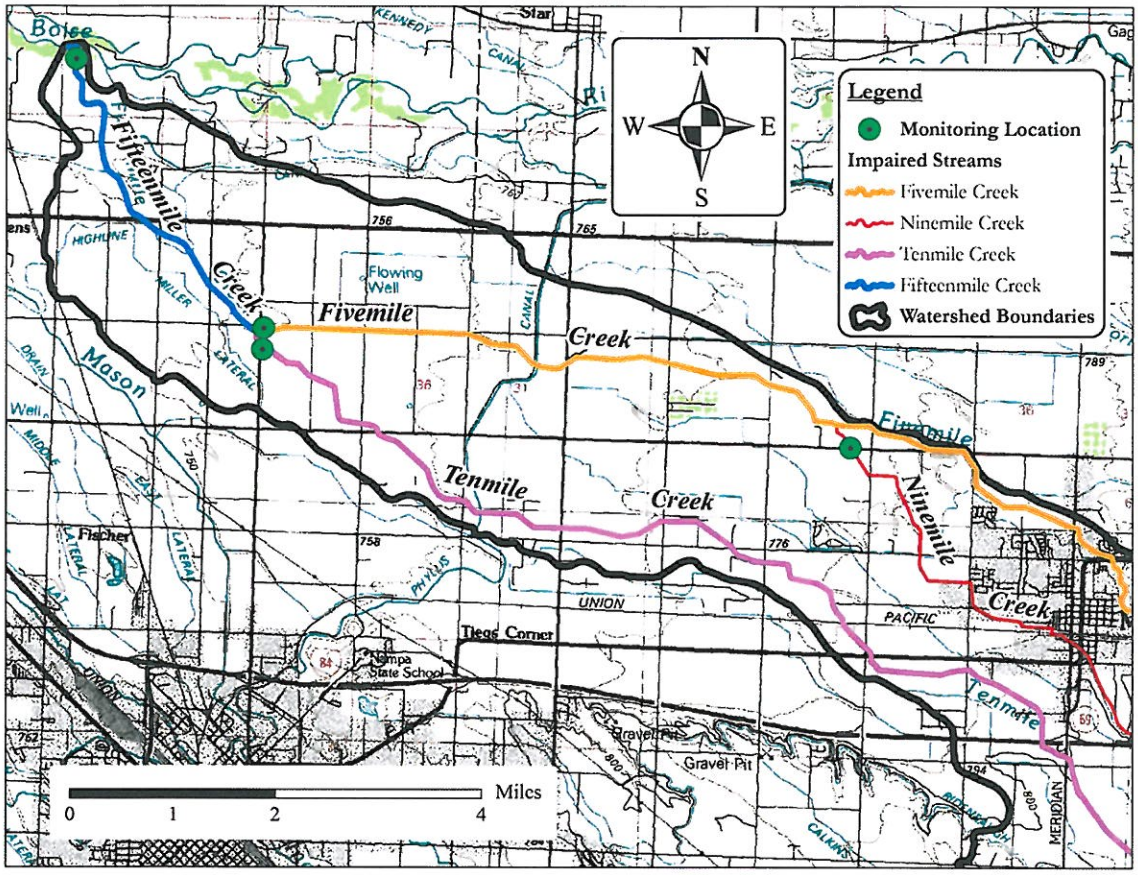

Figure 1. Monitoring locations.

Method

Bacteria samples were collected from each site every 3 to 7 days during the months of July and November.

Sediment samples were collected from the Fivemile and Tenmile sites once every 2 weeks between June and November 2011. Replicate samples across the width of each culvert demonstrated that a simple depth-integrated sample from the center of each culvert would properly represent each stream. Stream discharge was measured concurrently with each sediment sample. Sediment concentrations were calculated for Fifteenmile Creek based on the measured values from Fivemile and Tenmile Creeks.

Results

Bacteria

The Idaho water quality criterion for *E. coli* is 126 organisms per 100 milliliters (mL), collected as a geometric mean of five samples spaced over a 30-day period. Table 2 and Figure 4 show the results from data collection during July and November 2011.

Table 1. *E. coli* data for Fivemile, Ninemile, Tenmile, and Fifteenmile Creeks.

Date (2011)	Number of *E. coli* per 100 milliliters			
	Fivemile Creek at mouth	Ninemile Creek at Ustick Road	Tenmile Creek at mouth	Fifteenmile Creek at mouth
July 1	933.1	488.4	988.1	579.0
July 5	435.2	1528.6	344.8	275.5
July 8	989.5	1420.9	1046.0	986.7
July 13	933.1	410.6	668.6	547.5
July 18	710.8	410.6	702.7	2723.0
July Geometric Mean	**767.6**	**708.8**	**699.5**	**748.3**
November 2	74.9	1119.9	74.9	83.9
November 7	32.3	613.1	75.4	52.8
November 13	93.2	501.2	33.6	172.6
November 16	19.9	241.9	24.9	10.8
November 21	34.1	238.2	40.4	21.6
November Geometric Mean	**43.3**	**456.5**	**45.3**	**44.7**

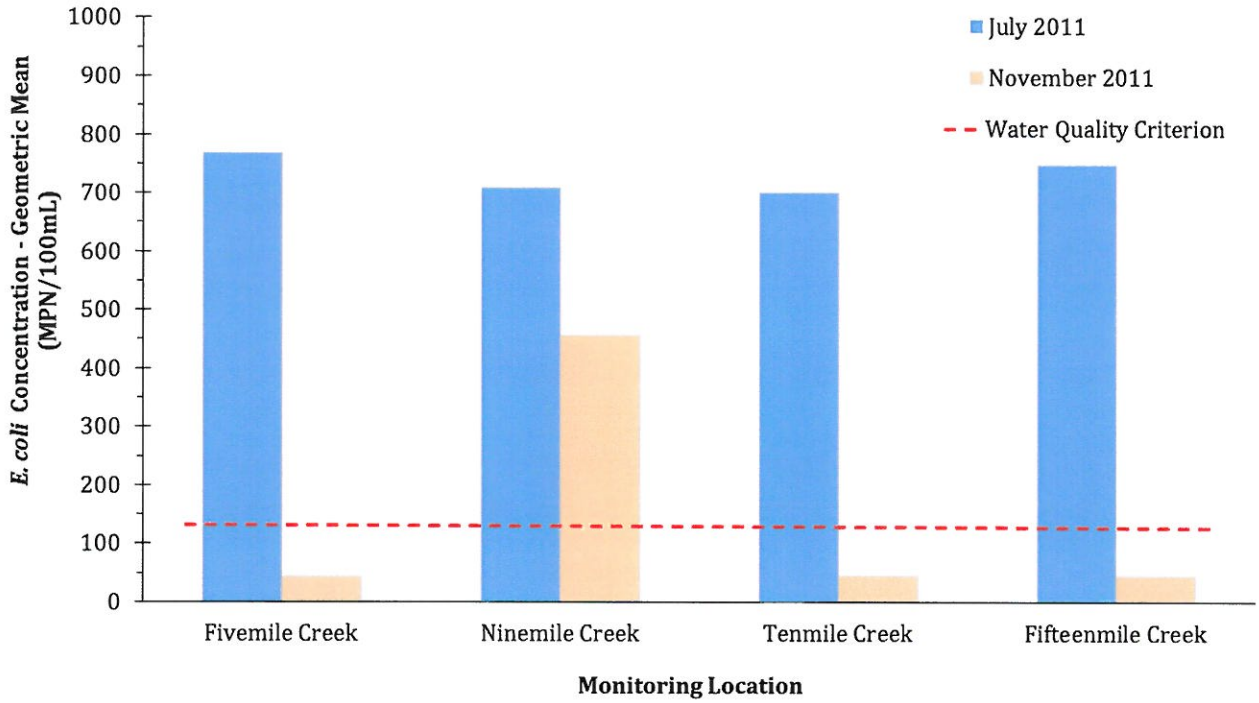

Figure 2. Geometric mean *E. coli* concentrations for Fivemile, Ninemile, Tenmile, and Fifteenmile Creeks, reported as most probable number (MPN) per 100 milliliters (mL).

Sediment

Table 1 shows the sediment and discharge measurements for each visit to Fivemile and Tenmile Creeks and the sediment load calculation for Fifteenmile Creek. Discharge data were not collected on the first two visits because of dangerous site conditions. Sediment concentrations are illustrated in Figure 2.

Table 2. Sediment data for Fivemile, Tenmile, and Fifteenmile Creeks

Date (2011)	Approx. Time	Fivemile Creek at mouth			Tenmile Creek at mouth			Fifteenmile Creek
		TSS[a] (mg/L)	Discharge (cfs[b])	Sediment Load (tons/day)	TSS (mg/L)	Discharge (cfs)	Sediment Load (tons/day)	Sediment Load[c] (tons/day)
June 16	1500	46	n/a	n/a	36	n/a	n/a	n/a
July 1	1100	49	n/a	n/a	90	n/a	n/a	n/a
July 18	1100	70	43.2	8.1	160	75.0	32.3	40.5
July 29	1200	62	69.3	11.6	230	65.6	40.7	52.2
Aug 10	1800	98	71.5	18.9	69	66.2	12.3	31.2
Aug 25	0600	50	71.9	9.7	82	84.5	18.7	28.4
Sept 8	0700	18	65.3	3.2	64	61.5	10.6	13.8
Sept 19	1100	24	67.3	4.4	18	61.4	3.0	7.3
Oct 5	1500	38	107.8	11.0	47	82.5	10.4	21.5
Nov 2	1300	5	26.0	0.4	5	11.8	0.2	0.5
Nov 16	1230	5	28.5	0.4	5	10.1	0.1	0.5

[a] TSS = total suspended solids, measured in milligrams per liter (mg/L)
[b] cfs = cubic feet per second
[c] Fifteen Mile Creek sediment load was calculated by combining the sediment loads of Fivemile and Tenmile Creeks. Numbers may not total exactly due to rounding.

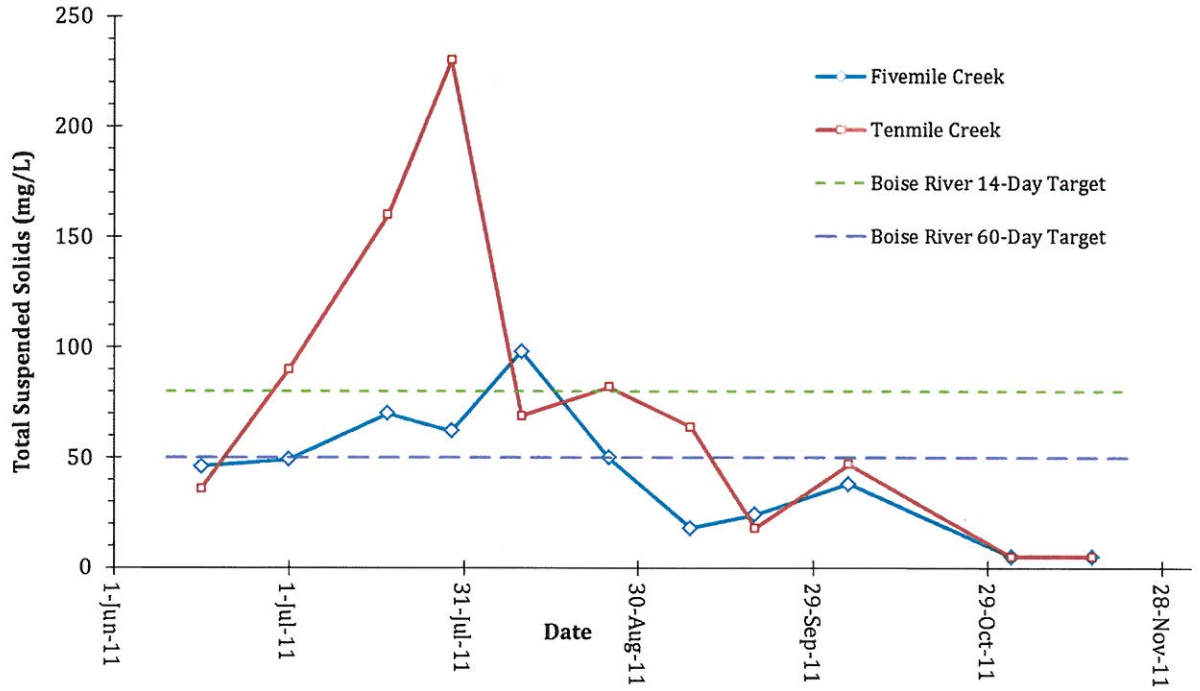

Figure 3. Total suspended solids concentration for Fivemile and Tenmile Creeks.

Figure 3 shows the sediment loads contributed by each creek. The sediment load for Fifteenmile Creek was calculated by combining the loads of Fivemile and Tenmile Creeks. Several other small sediment contributions likely exist along the length of Fifteenmile Creek, but these are not accounted for.

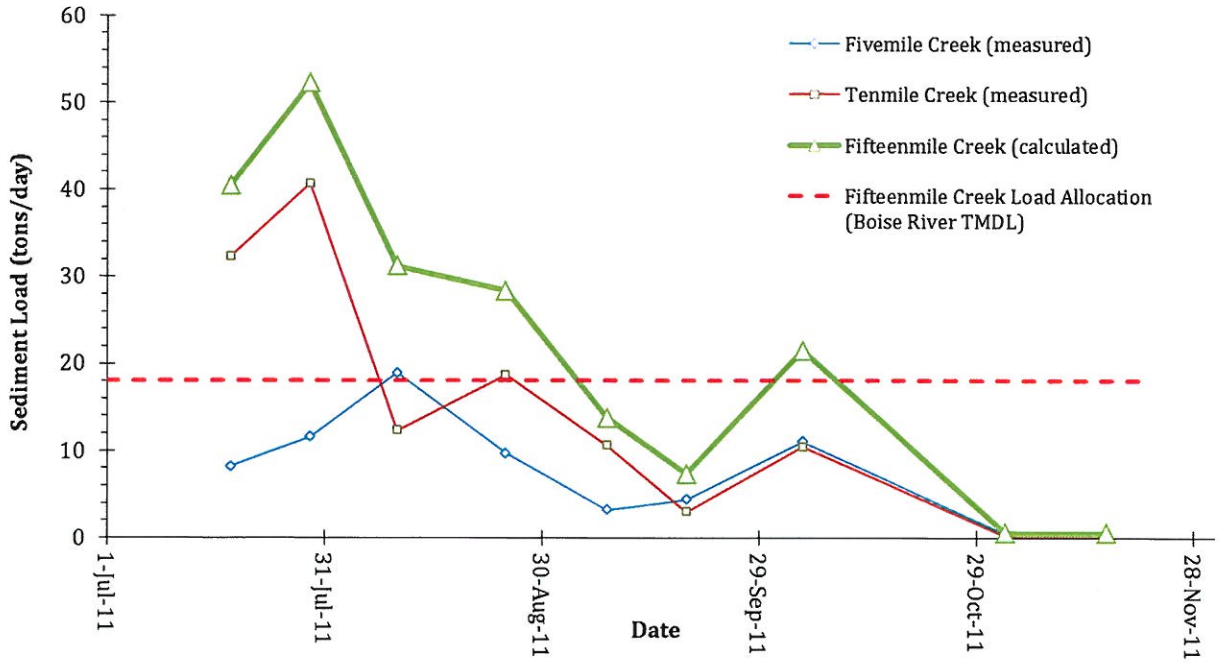

Figure 4. Sediment loads from Fivemile, Tenmile, and Fifteenmile Creeks.

Turbidity

During the course of the study, turbidity was added as an analyte. Turbidity measurements may allow DEQ to establish a regression analysis, which would be needed if a continuous sediment monitoring station were to be installed. Table 3 directly compares the measured values for turbidity and total suspended solids (TSS).

Table 3. Turbidity data for Fivemile and Tenmile Creeks.

Date (2011)	Fivemile Creek at mouth		Tenmile Creek at mouth	
	Turbidity (NTU[a])	TSS (mg/L)	Turbidity (NTU)	TSS (mg/L)
September 8	12.0	18	28.0	64
September 19	16.0	24	9.0	18
October 5	19.0	38	23.0	47
November 2	3.4	5	1.3	5
November 16	2.5	5	1.5	5

[a] NTU = nephelometric turbidity units

Quality Assurance

Blanks

Blank samples are used to show that there is no equipment contamination.

A blank bacteria sample was collected on November 16, 2011. It returned <1 *E. coli* per 100 mL, demonstrating that there is no bacteriological contamination in the sampling process.

A blank sediment sample was collected on July 1, 2011. It returned a sediment concentration of <1 mg/L, demonstrating that there is no sediment contamination in the sampling process.

Replicates

Replicate samples demonstrate the repeatability of measurements. Duplicate bacteria samples were collected from Ninemile Creek on November 16, 2011. They returned 261.3 and 222.4 *E. coli* per 100 mL—a relative percent difference (RPD) of 16%.

Three triplicate sediment samples were collected from Fivemile Creek on June 16, 2011. They returned 46, 47, and 48 mg/L, representing a maximum RPD of 4%.

Sediment samples were also collected from the left, center, and right sides of the channel on June 16, 2011. These returned 46, 47, and 45 mg/L, respectively. These values represent an RPD of 4% and demonstrate that sediment concentrations are equal across the width of the creek, within experimental error.

Cost Summary

Data Analysis

Bacteria analysis (44 samples, at $26 per sample):	$1144
Sediment analysis (22 samples, at $14 per sample):	$308
Turbidity analysis (10 samples, at $10.50 per sample):	$105
Total:	*$1557*

(slightly more than planned because of addition of turbidity analyses)

Personnel

Bacteria staff time (1 person, 10 × 2 hour visits):	20 hours
Sediment staff time (1.5 people, 11 × 4 hour visits):	66 hours
Total:	*86 hours*

(less than planned because of efficiency)

Conclusions

- Fivemile, Ninemile, Tenmile, and Fifteenmile Creeks are all severely impaired by *E. coli* bacteria during irrigation season. Bacteria levels drop below the water quality criterion in November, except in Ninemile Creek, which remains impaired.
- Tenmile Creek's suspended sediment concentrations can be as high as 230 mg/L. It exceeded the Boise River chronic sediment target of 50 mg/L between July 1 and September 8, 2011.
- Fivemile Creek's suspended sediment concentrations can be as high as 98 mg/L. It exceeded the Boise River chronic sediment target of 50 mg/L between July 18 and August 25, 2011.
- Suspended sediment concentrations in both Fivemile and Tenmile Creeks decline to approximately 5 mg/L in November.
- At its worst, Fifteenmile Creek contributes more than 50 tons per day of sediment into the Boise River. This number declines to 0.5 tons per day in November. Its load allocation is 18.02 tons per day.